CLAIMS

What is claimed is:

1.   A method of scheduling use of a resource shared by a plurality of user candidates,

5   the method comprising:

assigning a utility function to each of the candidates;

for each candidate, jointly evaluating the utility functions to determine an outcome

that would arise from serving the candidate under consideration to the

exclusion of the other candidates; and

10   serving the candidate having the most favorable outcome.

2.   The method of claim 1 wherein assigning a utility function to each of the plurality of

candidates comprises assigning the same utility function to all the candidates.

15 3.   The method of claim 1 wherein the plurality of candidates comprise at least two

users classes, and wherein assigning a utility function to each of the plurality of candidates

comprises assigning one of at least two utility functions to candidates based on said user

class.

20 4.   The method of claim 1 wherein assigning a utility function to each of the plurality of

candidates comprises assigning one of two or more utility functions to each candidate based

on a desired quality of service associated with the candidate.

5.   The method of claim 1 wherein assigning a utility function to each of the plurality of candidates comprises assigning one of at least two utility functions to each candidate based on a time of day.

6.   The method of claim 5 further comprising assigning a particular one of said at least
5   two utility functions to the candidate based on a user class of the candidate.

7.   The method of claim 1 wherein said resource comprises an air interface supporting RF communication between the candidates and a HDR communication network, and wherein said scheduling of candidates comprises scheduling use of said air interface.

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8.   The method of claim 7 further comprising defining one or more of said utility functions such that scheduling of the candidates is biased towards achieving a target average data throughput for one or more of the candidates.

15   9.   The method of claim 8 further comprising applying a barrier function to said one or more utility functions to effect said biasing.

10.   The method of claim 7 wherein each of the candidates has a corresponding average data throughput based on past service to the candidate, and further comprising capping the
20   utility functions assigned to one or more of the candidates to limit the average data throughput achievable by said one or more of the candidates.

11.   The method of claim 7 wherein each of the candidates has a corresponding average data throughput based on past service to the candidate, and further comprising limiting a
25   minimum value of the utility functions assigned to one or more of the candidates to attempt

to maintain the average data throughput of said one or more of the candidates above a

desired minimum value.

12.   The method of claim 7 further comprising defining said utility functions to be

5   functions of an average data throughput associated with each of the candidates, said

average data throughput dependent upon past scheduling of the candidate.

13.   The method of claim 12 further comprising receiving service request information from

the candidates defining an amount of data desired by each candidate during a subsequent

10   service interval.

14.   The method of claim 13 wherein jointly evaluating said utility functions to determine

an outcome comprises determining a net change in benefit that would arise from serving the

candidate under consideration in accordance with said service request information to the

15   exclusion of the other candidates during at least a portion of said subsequent service

interval.

15.   The method of claim 1 wherein for each candidate, jointly evaluating said utility

functions comprises determining an aggregate change in benefit that would arise from

20   serving the candidate under consideration and not serving the remaining candidates.

16.   The method of claim 15 wherein determining an aggregate change in benefit

comprises evaluating the overall change in benefit as given by the utility functions assigned

to the candidates that would result from selecting the candidate under consideration for

25   service.

17.   The method of claim 1 further comprising performing said steps of evaluating and serving at repeated serving intervals, such that the candidates are generally served by a schedule that tends to maximize an overall benefit.

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18.   A method of scheduling use of an air interface in a HDR communication network between a plurality of user candidates in each of a succession of service intervals, the method comprising:

tracking average served rates for the candidates, where said average served rates

10   are dependent upon scheduling decisions made in past service intervals;

for each candidate, evaluating an objective function having an initial value dependent

upon said average served rates and a next value dependent upon an

aggregate change that would arise from serving the candidate under

consideration to the exclusion of the other candidates; and

15   serving the candidate that yields the most favorable aggregate change in said

objective function.

19.   The method of claim 18 further comprising assigning a utility function to each said candidate, said utility functions characterizing the benefit of serving said candidates as

20   functions of said average served rates.

20.   The method of claim 19 further comprising defining said objective function to be a function of said utility functions such that said aggregate changes in said objective function reflect aggregate changes in benefit.

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21.   The method of claim 19 further comprising assigning a first utility function to a first

set of candidates and assigning a second utility function to a second set of candidates, such

that said first and second sets of candidates have different scheduling priorities, and

wherein said first and second sets of candidates together comprise said plurality of

5   candidates.

22.   The method of claim 19 further comprising defining one or more ones of said utility

functions as time-dependent utility functions, such that candidates assigned a time-

dependent utility function have a time-dependent scheduling priority.

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23.   The method of claim 19 further comprising assigning multiple utility functions to one

or more of said candidates, such that a scheduling priority of the candidate depends upon

said multiple functions.

15   24.   The method of claim 19 further comprising limiting a lower value of one or more of

said utility functions so that one or more of said candidates are scheduled for service in a

manner that attempts to maintain said average served data rates for said one or more

candidates above a minimum data rate.

20   25.   The method of claim 19 further comprising limiting an upper value of one or more of

said utility functions so that one or more of said candidates are scheduled in a manner such

that said average served data rates for said one or more candidates remains below a

maximum data rate.

26.   The method of claim 18 further comprising incorporating a barrier function into said objective function such that said candidates are scheduled according to a constraint imposed by said barrier function.

5   27.   The method of claim 18 further comprising, for each candidate, determining said next value of said objective function based on a desired data rate for serving said candidate under consideration.

28.   The method of claim 27 further comprising receiving said desired data rate from said

10   candidate.

29.   The method of claim 28 further comprising receiving desired data rate from said candidate as a DRC value transmitted from said candidate to said HDR communication network.

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30.   A method of scheduling use of a resource shared by a plurality of user candidates, the method comprising:

        defining a set of two or more utility functions;

        assigning each candidate to a user class;

20   assigning a utility function to each candidate based on the user class of said candidate;

        for each candidate, jointly evaluating said utility functions for all candidates to determine a selection metric associated with potentially serving the candidate under consideration; and

allocating the shared resource for a designated time to the candidate having the

most favorable selection metric.

31.   The method of claim 30 wherein allocating said shared resource for a designated

5   time to the candidate having the most favorable selection metric comprises allocating said

resource to the candidate that maximizes the selection metric.

32.   The method of claim 30 further comprising associating differing qualities of service

with said user classes, such that candidates from a user class having a relatively higher

10   associated quality of service are favored in said allocation of said resource.

33.   The method of claim 32 wherein said resource comprises an air interface in a HDR

communication network, and wherein candidates in said user class having a relatively

higher associated quality of service are scheduled for use of said air interface to achieve

15   relatively higher average data throughputs to those candidates.

34.   The method of claim 30 further comprising defining said utility functions to

characterize the benefit of serving said candidates.

20   35.   The method of claim 34 further comprising defining said utility functions to be

functions of average served data rates associated with past service to said candidates, such

that a benefit value associated with serving a given one of said candidates depends upon

the average served data rate associated with said candidate and the particular utility

function assigned to said candidate.

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36.   The method of claim 35 further comprising determining a change in benefit for each said candidate by determining an incremental change in average served data rate that would arise from serving said candidate in the designated time.

5   37.   The method of claim 36 wherein jointly evaluating said utility functions for all candidates to determine said selection metric comprises determining a net change in overall benefit that would arise from serving each candidate under consideration to the exclusion of the other candidates for a defined time.

10   38.   A method of scheduling use of a resource shared by a plurality of user candidates, the method comprising:

defining a set of two or more utility functions;

assigning a utility function to each of the candidates, wherein the utility function assigned to at least one of the candidates is a function of time;

15   for each candidate, jointly evaluating the utility functions for all candidates to determine a selection metric associated with potentially serving the candidate under consideration; and

allocating the shared resource for a designated time to the candidate having the most favorable selection metric.

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39.   The method of claim 38 further wherein the utility function assigned to said at least one of said candidates is made time dependent by including a time-dependent weighting factor in said utility function.

40.   The method of claim 39 further comprising adjusting a scheduling priority based on a
time of day for said at least one candidate assigned said time-dependent utility function.

41.   The method of claim 38 further comprising:

5   assigning individual ones of said candidates to one of at least two user classes;

assigning time-dependent utility functions to candidates in at least one of said user

classes, such that candidates in said at least one user class have scheduling

priorities dependent upon the time of day.

10   42.   The method of claim 38 adjusting the utility function that is a function of time such
that a scheduling priority of candidates assigned said utility function changes as a function
of time.

43.   A communication network entity for use in a HDR network and adapted to schedule
15   use of an air interface shared by a plurality of user candidates, said network entity
comprising a processor adapted to:

assign a utility function to each of the candidates;

jointly evaluate the utility functions to determine an outcome that would arise from

serving each candidate to the exclusion of the other the

20   candidates for a defined time; and

select the candidate having the most favorable outcome for service.

44.   The network entity of claim 43 wherein said processor assigns the same utility
function to all said candidates.

45.   The network entity of claim 43 wherein said processor assigns a first utility function to at least one of said candidates, and assigns a different, second utility function to another one of said candidates.

5   46.   The network entity of claim 45 wherein said processor assigns said first utility function to candidates in a first user class and assigns said second utility function to candidates in a second user class, said first and second utility functions defined to permit candidates in said first and second user classes to be scheduled with different priorities.

10   47.   The network entity of claim 46 where said processor schedules candidates in said first and second of user classes to provide different qualities of service to candidates in different user classes.

48.   The network entity of claim 43 wherein said processor assigns one of two or more

15   utility functions to each candidate based on a desired quality of service associated with said candidate.

49.   The network entity of claim 43 wherein said processor assigns a time-dependent utility function to at least one of said candidates, such that said candidate has a time-

20   dependent scheduling priority.

50.   The network entity of claim 49 wherein said processor determines whether or not to assign a time-dependent utility function to a given candidate based on a user class associated with said given candidate.

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51.   The network entity of claim 43 wherein said processor biases scheduling of said candidates to move an average served data rate of one or more ones of said candidates towards a target average served data rate.

5   52.   The network entity of claim 51 wherein said processor effects said biasing by defining one or more of said utility functions according to a desired biasing scheme.

53.   The network entity of claim 51 wherein said processor applies a barrier function to one or more of said utility functions to effect said biased scheduling.

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54.   The network entity of claim 43 wherein said processor biases scheduling said candidates to maintain an average served data rate of one or more of said candidates above a desired minimum threshold.

15   55.   The network entity of claim 54 wherein said processor applies a barrier function to one or more ones of said utility functions to effect said biased scheduling.

56.   The network entity of claim 43 wherein said processor:

tracks an average served data rate for each of said candidates; and

20   defines said utility functions to be functions of said average served data rates, such that a change in benefit arising from serving a given one of said candidates is a function of an incremental change in said average served data rate that would result from serving said given one of said candidates.

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57.   The network entity of claim 56 wherein said processor:

associates a desired data rate with each of said candidates; and

determines said incremental change in said average served rate based on serving

said given one of said candidates at said associated desired data rate.

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58.   The network entity of claim 56 wherein said processor limits the utility functions

assigned to one or more of said candidates to limit the average served data rate achievable

by said one or more candidates.

10   59.   The network entity of claim 56 wherein said processor bounds the utility functions

assigned to one or more of said candidates to maintain a minimum average served data rate

for said one or more candidates.

60.   The network entity of claim 43 wherein said network entity comprises a radio base

15   station that provides radio resources for communicating with said plurality of users via said

air interface.

61.   The network entity of claim 43 wherein said network entity comprises a base station

controller, said base station controller operative to control one or more radio base stations

20   that provide said air interface to said plurality of users.

62.   A method of scheduling use of a resource shared by a plurality of access terminals, the method comprising:

assigning a utility function to each of the access terminals;

for each access terminal, evaluating the utility functions of said plurality of access

5   terminals to determine an outcome that indicates potential changes

associated with said utility functions when said each access terminal is

served and the remaining access terminals are excluded from service; and

serving the access terminal having the outcome associated therewith that indicates

the most favorable potential changes.

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63.   The method of claims 62, wherein evaluating the utility functions of said plurality of

access terminals to determine an outcome includes jointly evaluating the utility functions of

said plurality of access terminals to determine the outcome.

15   64.   The method of claims 62, wherein each of the potential changes is a negative,

positive, or neutral beneficial change associated with the respective utility function.

65.   The method of claims 64, wherein serving the access terminal includes serving the

access terminal having the outcome associated therewith that indicates the highest number

20   of positive beneficial changes.